

## OCULAR ESTIMATES OF WESTERN SPRUCE BUDWORM DAMAGE IN EASTERN OREGON--1985

By

Roger Sandquist, Entomologist  
and Tommy Gregg, Statistician

### Introduction

Western spruce budworm, Choristoneura occidentalis Freeman (WSBW), continues to defoliate host species in central and eastern Oregon. Some areas in eastern Oregon have incurred their fifth year of defoliation and are now showing some bare-top and tree mortality.

In 1981, when it became apparent that an outbreak of WSBW was beginning, sample plots were established to determine current losses due to WSBW and gather background data for future impact assessment of the outbreak (Harvey 1981). Ten-point variable radius cluster plots were established at four locations: Mill Creek in the Cove Watershed and Marble Creek in the Baker Watershed, both on the Wallowa-Whitman National Forest; Ditch Creek, south of Heppner on the Umatilla National Forest; and Kline Spring, southeast of Prairie City on the Malheur National Forest.

After observing the extent and intensity of defoliation and apparent top-kill in 1985, Forest Pest Management entomologists became concerned that the impacts of WSBW may be underestimated in current analyses of the situation. The objectives of this study were to estimate the amount of defoliation for 1984 and 1985 and the apparent top-kill occurring in the four established plots.

### Sample Plot Description

Mill creek--This plot is located at T. 3 South, R. 41 East, NE 1/4 of section 29. The elevation is 5450 feet. This is a mature stand (116 ft ba/a) thinned in 1973 or 1974. It consists of lodgepole pine (40 ft ba/a), 8-12 inches dbh, and Douglas-fir (30 ft ba/a), 8-12 inches dbh. The stand is fairly open with thinning slash scattered over the area. Very little regeneration is apparent.

Marble Creek--This plot is located at T. 9 South, R. 38 East, SW 1/4 of section 12. The elevation is 5000 feet. This is a mature stand (104 ft ba/a), consisting of grand fir (78 ft ba/a), 8-18 inches dbh and Douglas-fir (14 ft ba/a), 12-20 inches dbh. The understory was established with about equal numbers of grand and Douglas-fir.

Ditch Creek--This plot is located at T. 5 South, R. 28 East, SW 1/4 of section 27. The elevation is 4500 ft. This is a mature stand (110 ft ba/a), predominantly grand fir (71.7 ft ba/a), 10-20 inches dbh, with Douglas-fir (13.3 ft ba/a), 10-20 inches dbh, and ponderosa pine (15 ft ba/a), 18-24 inches dbh. There is a moderately stocked understory of grand fir and pine. This area was treated with carbaryl in 1982.

Kline Spring--This plot is located at T. 13 South, R. 35 East, SW 1/4 of section 15. The elevation is 5900 feet. This is a mature stand (178 ft ba/a) predominantly lodgepole pine (78 ft ba/a), 8-14 inches dbh, with grand fir (58

ft ba/a), and Douglas-fir (26 ft ba/a), both 6-16 inches dbh. The understory is dominated by lodgepole pine. This area was treated with carbaryl in 1982.

Appendices A-D display the stand tables for basal areas per acre and trees per acre for the four plots.

### Methods

When establishing the plots in 1981 a 20 BAF wedge prism was used to determine those trees included within the plot. The trees were numbered and data was collected on each of these trees.

In 1985, ocular estimates of defoliation on current and last year's foliage were recorded independently for each third of the normal tree bole that supports live, green foliage. These estimates were made in late July and early August on all numbered host trees that were included in each plot. For each crown category, the defoliation was rated as one of the following classes:

- Class 0 no visible defoliation
- 1 1-25% defoliation
- 2 26-50% defoliation
- 3 51-75% defoliation
- 4 76-100% defoliation

Estimates of bare top (apparent top-kill) were determined ocularly as that percentage of the total bole of the tree that was devoid of foliage from the top of the tree. Using the baseline information collected in 1981 and the estimates of bare top in 1985, stand tables were constructed to summarize the data (see Appendices).

### Results and Discussion

Defoliation estimates indicate moderate to heavy defoliation in 1984 and generally heavy defoliation in 1985 at all locations. These estimates are from overstory trees within the variable radius plots and involve no understory. This information will be kept on file for later analysis with other years' defoliation estimates when the outbreak is over. Crimp (1982) found that binocular estimates of defoliation underestimate actual defoliation by ten percent. If true in this study, the actual defoliation in 1984 and 1985 was generally very heavy.

The damage estimate for grand fir used in the prognosis model (Wykoff et al 1985) is 11 percent of 6-12 inch dbh trees will have an average of 2 percent of their total height top-killed (var 0.4) during the whole outbreak. For 6-12 inch dbh Douglas-fir, 7 percent of the trees will have an average of 2 percent of their total height top-killed (var 0.4) during the whole outbreak. Table 1 shows the extent and intensity of bare top at the four plot locations. Three out of four plots exceeded the damage levels currently used.

**Table 1. Western Spruce Budworm-Caused Bare Top of Host Trees  
In Eastern Oregon Sample Plots.**

<u>Location</u>	<u>Grand fir</u>		<u>Douglas-fir<sup>1/</sup></u>	
	<u>% of trees with bare top</u>	<u>mean bare top (% of total bole)</u>	<u>% of trees with bare top</u>	<u>mean bare top (% of total bole)</u>
Mill Creek	86.7	9.7 $\pm$ 4.9	40.5	4.0 $\pm$ 5.0
Marble Creek	94.2	13.6 $\pm$ 6.4	45.4	6.0 $\pm$ 7.7
Ditch Creek <sup>2/</sup>	7.7	1.8 $\pm$ 7.2	0	- -
Kline Spring <sup>2/</sup>	22.4	2.2 $\pm$ 4.2	27.2	2.7 $\pm$ 4.5

<sup>1/</sup> The occurrence of Douglas-fir in these plots is so low that the data here may not represent what happens to this species when found in greater numbers.

<sup>2/</sup> Carbaryl was applied to these areas in 1982.

The Ditch Creek and Kline Spring plots are apparently suffering less damage than the other two plots. There are two factors which may account for this difference. Kline Spring is a high-elevation site (5900 ft.) at the edge of subalpine fir habitat and may not support a high budworm population density. Secondly, both Kline Spring and Ditch Creek were treated with the insecticide carbaryl in 1982. The intensity of 1984 and 1985 defoliation seemed less at Ditch Creek than the other three areas from a cursory inspection of the defoliation estimates.

While generalizations cannot be made from these four plots to represent the entire outbreak area in eastern Oregon, the information supports the idea that more damage may be occurring than has been estimated in environmental analyses of the situation. Because of the disparity between the damage estimates used in analyzing the current outbreak and the apparently higher levels of bare top already occurring on these plots, it is desirable to determine if damage estimates must be modified in subsequent analyses. The differences between plots suggest considerable variation in damage due to budworm. The cumulative effect of this defoliation is unknown. It is safe to assume that the general tree condition is declining and will probably continue to decline until after the outbreak subsides. Future site-specific analyses may allow managers to be more discriminating in their damage simulations and in assigning treatment priority to prevent or reduce damage from budworm defoliation.

The percent of trees having noticeable bare top and the mean and standard deviation of the percent of total bole of the tree having bare top, are the parameters that can be used in the prognosis model (Wykoff et al 1985). Also a designation of trees into three height classes is needed to drive the TOP-KILL portion of the model. This latter information is readily available from routine plot installation records.

Additional information is needed to adjust the damage in our simulations to reflect the on-the-ground damage.

Detailed damage estimates should be developed which represent specific sites and conditions. Damage estimates for understory are lacking and should be developed. The use of geographic information system technology should be evaluated to store, manipulate and display this and other information to allow rapid and accurate analysis.

Acknowledgement-The assistance of Tim McConnell in collecting the data on the Kline Springs plot is acknowledged and appreciated.

## References

Crimp, P. M.

1982. Impacts of Western Budworm on Tree Growth on the Eastern Slope of the Washington Cascades. Unpubl. M. S. Thesis, Univ. Washington, Seattle, WA. 130 p.

Harvey, R. D., Jr.

1981. Effects of Western Spruce Budworm Feeding on Douglas-fir and True Firs of Eastern Oregon. Forest Pest Management special evaluation. USDA Forest Service, Pacific Northwest Region, Portland, OR.

Wykoff, W. R.

----. Supplement to the users guide of stand prognosis model--version 5.0 (Draft). INT.-\_\_\_\_\_, Ogden, Ut: USDA Forest Service, Intermountain Forest and Range Experiment Station.

## **Appendix A Mill Creek**

STAND TABLE NO. 1

R6-SBW IMPACT PLOTS 1981-1985

MILL PLOT

## \*\*\* STAND TABLE OF BASAL AREAS PER ACRE \*\*\*

DIAMETER CLASS	DOUGLAS FIR	GRAND FIR	WESTERN LARCH	ENGLEMAN SPRUCE	PONEROSA PINE	LONGPOLE PINE	TOTAL ALL CLASSES
-------------------	----------------	--------------	------------------	--------------------	------------------	------------------	----------------------

4	.0	.0	.0	.0	.0	.0	.0
6	.0	2.0	.0	.0	.0	.0	2.0
8	4.0	2.0	.0	.0	.0	14.0	20.0
10	10.0	22.0	4.0	.0	.0	16.0	52.0
12	12.0	10.0	2.0	.0	.0	10.0	34.0
14	2.0	2.0	2.0	.0	.0	.0	6.0
16	2.0	.0	.0	.0	.0	.0	2.0
18	.0	.0	.0	.0	.0	.0	.0

TOTAL	30.0	38.0	8.0	.0	.0	40.0	116.0
PERCENT	25.9	32.8	6.9	.0	.0	34.5	100.0
DBH(MDN)	11.4	10.6	11.6	.0	.0	9.9	10.6
NO. SAMPLES	10	10	10	10	10	10	10
CV%	105.4	130.1	174.8	.0	.0	100.0	33.3
SE(MEAN)	10.000	16.720	4.422	.000	.000	12.649	12.220
SE%	33.3	44.0	55.3	.0	.0	31.6	10.9

R6-SBW IMPACT PLOTS 1981-1985

HILL PLOT

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	DOUGLAS FIR	GRAND FIR	WESTERN LARCH	ENGLEMAN SPRUCE	PONEROSA PINE	LOGPOLE PINE	TOTAL ALL CLASSES
-------------------	----------------	--------------	------------------	--------------------	------------------	-----------------	----------------------

4	.0	.0	.0	.0	.0	.0	.0
6	.0	10.2	.0	.0	.0	.0	10.2
8	11.5	5.7	.0	.0	.0	40.1	57.3
10	18.3	40.4	7.4	.0	.0	29.3	95.4
12	15.3	12.7	2.5	.0	.0	12.7	43.2
14	1.9	1.9	1.9	.0	.0	.0	5.7
16	1.4	.0	.0	.0	.0	.0	1.4
18	.0	.0	.0	.0	.0	.0	.0

TOTAL	48.4	70.9	11.8	.0	.0	82.1	213.2
PERCENT	22.7	33.3	5.5	.0	.0	38.5	100.0
DBH(MOD)	10.7	9.9	11.2	.0	.0	9.4	10.0
NO. SAMPLES	10	10	10	10	10	10	10
CV%	107.0	145.4	172.1	.0	.0	113.9	37.2
SE(MEAN)	16.374	32.587	6.394	.000	.000	29.587	25.071
SE%	33.8	46.0	54.4	.0	.0	36.0	11.8



DATE: 10/15/85

PAGE 3

STAND TABLE NO. 2

R6-SBW IMPACT PLOTS

1981-1985

HILL PLOT

\*\*\* PERCENT BARE TOP GRAND FIR \*\*\*

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	GREEN TOP	ONE PERCENT	TWO PERCENT	THREE PERCENT	FOUR+ PERCENT	OTHERS	TOTAL ALL CLASSES
-------------------	--------------	----------------	----------------	------------------	------------------	--------	----------------------

4	.0	.0	.0	.0	.0	.0	.0
6	.0	10.2	.0	.0	.0	.0	10.2
8	5.7	.0	.0	.0	.0	51.6	57.3
10	3.7	29.3	7.3	.0	.0	55.1	95.4
12	.0	12.7	.0	.0	.0	30.6	43.3
14	.0	1.9	.0	.0	.0	3.7	5.6
16	.0	.0	.0	.0	.0	1.4	1.4
18	.0	.0	.0	.0	.0	.0	.0

TOTAL	9.4	54.1	7.3	.0	.0	142.4	213.2
PERCENT	4.4	25.4	3.4	.0	.0	66.8	100.0
DBH(MOD)	9.8	10.1	10.0	.0	.0	10.0	10.0
NO. SAMPLES	10	10	10	10	10	10	10
CVZ	217.1	167.6	210.8	.0	.0	63.2	37.2
SE(MEAN)	6.450	28.680	4.889	.000	.000	28.435	25.071
SEZ	68.6	53.0	66.7	.0	.0	20.0	11.8

DATE: 10/15/85

PAGE 3

STAND TABLE NO. 2

K6-SBW IMPACT PLOTS 1981-1985

HILL PLOT \*\*\* PERCENT BARE TOP DOUGLAS-FIR \*\*\*

\*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	GREEN TOP	ONE PERCENT	TWO PERCENT	THREE PERCENT	FOUR+ PERCENT	OTHERS	TOTAL ALL CLASSES
4	.0	.0	.0	.0	.0	.0	.0
6	.0	.0	.0	.0	.0	10.2	10.2
8	5.7	5.7	.0	.0	.0	45.8	57.2
10	11.0	7.4	.0	.0	.0	77.1	95.5
12	10.2	5.1	.0	.0	.0	28.0	43.3
14	1.9	.0	.0	.0	.0	3.7	5.6
16	.0	1.4	.0	.0	.0	.0	1.4
18	.0	.0	.0	.0	.0	.0	.0
TOTAL	28.8	19.6	.0	.0	.0	164.8	213.2
PERCENT	13.5	9.2	.0	.0	.0	77.3	100.0
DBH(MOD)	10.7	10.6	.0	.0	.0	9.8	10.0
NO. SAMPLES	10	10	10	10	10	10	10
CV%	137.1	126.2	.0	.0	.0	58.7	37.2
SE(MEAN)	12.481	7.821	.000	.000	.000	30.607	25.071
SEX	43.4	39.9	.0	.0	.0	18.6	11.8

**Appendix B**  
**Marble Creek**

STAND TABLE NO. 1

R6-SBW IMPACT PLOTS 1981-1985

BAKER PLOT

## \*\*\* STAND TABLE OF BASAL AREAS PER ACRE \*\*\*

=====

DIAMETER CLASS	DOUGLAS FIR	GRAND FIR	WESTERN LARCH	ENGLEMAN SPRUCE	PONEROSA PINE	LODGPOLE PINE	TOTAL-ALL CLASSES
-------------------	----------------	--------------	------------------	--------------------	------------------	------------------	----------------------

=====

4	.0	.0	.0	.0	.0	.0	.0
6	.0	4.0	.0	.0	.0	.0	4.0
8	.0	16.0	.0	.0	.0	.0	16.0
10	.0	10.0	2.0	.0	.0	.0	12.0
12	2.0	22.0	2.0	.0	.0	2.0	28.0
14	4.0	8.0	.0	2.0	.0	.0	14.0
16	2.0	6.0	2.0	.0	.0	.0	10.0
18	.0	8.0	.0	.0	.0	.0	8.0
20	2.0	4.0	.0	.0	.0	.0	6.0
22	.0	.0	.0	.0	.0	.0	.0
24	.0	.0	.0	.0	.0	.0	.0
26	4.0	.0	.0	.0	.0	.0	4.0
28	.0	.0	2.0	.0	.0	.0	2.0
30	.0	.0	.0	.0	.0	.0	.0

-----

TOTAL	14.0	78.0	8.0	2.0	.0	2.0	104.0
PERCENT	13.5	75.0	7.7	1.9	.0	1.9	100.0
DBH(MOD)	19.1	12.7	17.9	14.0	.0	12.0	14.2
NU.SAMPLES	10	10	10	10	10	10	10
CV%	117.6	72.0	174.8	316.2	.0	316.2	68.3
SE(MEAN)	5.207	17.751	4.422	2.000	.000	2.000	22.470
SEX	37.2	22.8	55.3	100.0	.0	100.0	21.6

=====

STAND TABLE NO. 2

R6-SBW IMPACT PLOTS 1981-1985

BAKER PLOT

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	DOUGLAS FIR	GRAND FIR	WESTERN LARCH	ENGELMAN SPRUCE	PONEROSA PINE	LODGPOL PINE	TOTAL ALL CLASSES
-------------------	----------------	--------------	------------------	--------------------	------------------	-----------------	----------------------

4	.0	.0	.0	.0	.0	.0	.0
6	.0	20.4	.0	.0	.0	.0	20.4
8	.0	45.9	.0	.0	.0	.0	45.9
10	.0	18.3	3.7	.0	.0	.0	22.0
12	2.5	28.0	2.5	.0	.0	2.5	35.5
14	3.8	7.5	.0	1.9	.0	.0	13.2
16	1.4	4.3	1.4	.0	.0	.0	7.1
18	.0	4.5	.0	.0	.0	.0	4.5
20	.9	1.8	.0	.0	.0	.0	2.7
22	.0	.0	.0	.0	.0	.0	.0
24	.0	.0	.0	.0	.0	.0	.0
26	1.1	.0	.0	.0	.0	.0	1.1
28	.0	.0	.5	.0	.0	.0	.5
30	.0	.0	.0	.0	.0	.0	.0

TOTAL	9.7	130.7	8.1	1.9	.0	2.5	152.9
PERCENT	6.3	85.5	5.3	1.2	.0	1.6	100.0
DBH(MD)	15.3	10.5	13.5	14.0	.0	12.0	11.2
NO. SAMPLES	10	10	10	10	10	10	10
CV%	160.1	89.9	169.2	316.2	.0	316.2	84.1
SE(MEAN)	4.923	37.156	4.341	1.871	.000	2.546	40.669
SEX	50.6	28.4	53.5	100.0	.0	100.0	26.6

## STAND TABLE NO. 2

R6-SBW IMPACT PLOTS 1981-1985

BAKER PLOT \*\*\* PERCENT BARE TOP GRAND FIR \*\*\*

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	GREEN TOP	ONE PERCENT	TWO PERCENT	THREE PERCENT	FOUR+ PERCENT	OTHERS	TOTAL ALL CLASSES
4	.0	.0	.0	.0	.0	.0	.0
6	.0	10.2	10.2	.0	.0	.0	20.4
8	.0	28.6	17.2	.0	.0	.0	45.8
10	.0	11.0	3.7	3.7	.0	3.7	22.1
12	7.6	7.6	12.7	.0	.0	7.6	35.5
14	.0	3.7	3.7	.0	.0	5.6	13.0
16	.0	2.9	1.4	.0	.0	2.9	7.2
18	.0	2.3	2.3	.0	.0	.0	4.6
20	.0	1.8	.0	.0	.0	.9	2.7
22	.0	.0	.0	.0	.0	.0	.0
24	.0	.0	.0	.0	.0	.0	.0
26	.0	.0	.0	.0	.0	1.1	1.1
28	.0	.0	.0	.0	.0	.5	.5
30	.0	.0	.0	.0	.0	.0	.0

TOTAL	7.6	68.1	51.2	3.7	.0	22.3	152.9
PERCENT	5.0	44.5	33.5	2.4	.0	14.6	100.0
DBH(QMD)	12.0	10.4	10.4	10.0	.0	14.7	11.2
NO. SAMPLES	10	10	10	10	10	10	10
CV%	161.0	106.8	98.9	316.2	.0	101.9	84.1
SE(MEAN)	3.890	23.029	16.009	3.667	.000	7.169	40.669
SEX	50.9	33.8	31.3	100.0	.0	32.2	26.6

STAND TABLE NO. 2

R6-SBW IMPACT PLOTS 1981-1985

BAKER PLOT \*\*\* PERCENT BARE TOP DOUGLAS-FIR \*\*\*

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	GREEN TOP	ONE PERCENT	TWO PERCENT	THREE PERCENT	FOUR+ PERCENT	OTHERS	TOTAL ALL CLASSES
-------------------	--------------	----------------	----------------	------------------	------------------	--------	----------------------

4	.0	.0	.0	.0	.0	.0	.0
6	.0	.0	.0	.0	.0	20.4	20.4
8	.0	.0	.0	.0	.0	45.6	45.6
10	.0	.0	.0	.0	.0	22.0	22.0
12	2.5	.0	.0	.0	.0	33.1	35.6
14	1.9	1.9	.0	.0	.0	9.4	13.2
16	.0	.0	1.4	.0	.0	5.7	7.1
18	.0	.0	.0	.0	.0	4.5	4.5
20	.9	.0	.0	.0	.0	1.8	2.7
22	.0	.0	.0	.0	.0	.0	.0
24	.0	.0	.0	.0	.0	.0	.0
26	.0	1.1	.0	.0	.0	.0	1.1
28	.0	.0	.0	.0	.0	.5	.5
30	.0	.0	.0	.0	.0	.0	.0

TOTAL	5.3	3.0	1.4	.0	.0	143.2	152.9
PERCENT	3.5	2.0	.9	.0	.0	93.7	100.0
DBH(MM)	14.4	19.3	16.0	.0	.0	10.7	11.2
NO. SAMPLES	10	10	10	10	10	10	10
CV%	176.5	202.2	316.2	.0	.0	89.9	84.1
SE(MEAN)	2.978	1.890	1.432	.000	.000	40.719	40.669
SE%	55.8	63.9	100.0	.0	.0	28.4	26.6

**Appendix C**  
**Ditch Creek**



STAND TABLE NO. 1

R6-SBN IMPACT PLOTS 1981-1985

DITCH PLOT

## \*\*\* STAND TABLE OF BASAL AREAS PER ACRE \*\*\*

DIAMETER CLASS	DOUGLAS FIR	GRAND FIR	WESTERN LARCH	ENGLEMAN SPRUCE	PONEROSA PINE	LODGPOLE PINE	TOTAL ALL CLASSES
4	.0	.0	.0	.0	.0	.0	.0
6	.0	5.0	1.7	.0	.0	1.7	8.4
8	.0	.0	.0	.0	.0	3.2	3.2
10	1.7	10.0	.0	.0	.0	1.7	13.4
12	3.2	15.0	.0	.0	.0	.0	18.2
14	1.7	13.3	.0	.0	.0	.0	15.0
16	.0	15.0	.0	.0	.0	.0	15.0
18	1.7	5.0	.0	.0	3.4	.0	10.1
20	3.3	5.0	.0	.0	3.3	.0	11.6
22	.0	1.7	.0	.0	3.3	.0	5.0
24	.0	1.7	.0	.0	3.3	1.7	6.7
26	1.7	.0	.0	.0	.0	.0	1.7
28	.0	.0	.0	.0	.0	.0	.0
30	.0	.0	.0	.0	1.7	.0	1.7
32	.0	.0	.0	.0	.0	.0	.0
TOTAL	13.3	71.7	1.7	.0	15.0	8.3	110.0
PERCENT	12.1	65.2	1.5	.0	13.6	7.5	100.0
DBH(OMD)	17.3	14.6	6.0	.0	22.3	13.1	16.0
NO. SAMPLES	12	12	12	12	12	12	12
CV%	184.6	78.4	346.4	.0	128.7	190.3	61.8
SE(MEAN)	7.107	16.229	1.667	.000	5.573	4.578	19.618
SE%	53.3	22.6	100.0	.0	37.2	54.9	17.8

STAND TABLE NO. 2

R6-SBW IMPACT PLOTS 1981-1985

DITCH PLOT

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	DOUGLAS FIR	GRAND FIR	WESTERN LARCH	ENGLEMAN SPRUCE	PONEROSA PINE	LOGGPOLE PINE	TOTAL ALL CLASSES
-------------------	----------------	--------------	------------------	--------------------	------------------	------------------	----------------------

4	.0	.0	.0	.0	.0	.0	.0
6	.0	25.6	8.5	.0	.0	8.5	42.6
8	.0	.0	.0	.0	.0	9.5	9.5
10	3.1	18.3	.0	.0	.0	3.1	24.5
12	4.2	19.1	.0	.0	.0	.0	23.3
14	1.6	12.5	.0	.0	.0	.0	14.1
16	.0	10.7	.0	.0	.0	.0	10.7
18	.9	2.8	.0	.0	1.9	.0	5.6
20	1.5	2.3	.0	.0	1.5	.0	5.3
22	.0	.6	.0	.0	1.3	.0	1.9
24	.0	.5	.0	.0	1.1	.5	2.1
26	.5	.0	.0	.0	.0	.0	.5
28	.0	.0	.0	.0	.0	.0	.0
30	.0	.0	.0	.0	.3	.0	.3
32	.0	.0	.0	.0	.0	.0	.0

TOTAL	11.8	92.4	8.5	.0	6.1	21.6	140.4
PERCENT	8.4	65.8	6.1	.0	4.3	15.4	100.0
DBH(OMD)	14.4	11.9	6.0	.0	21.2	8.4	12.0
NO. SAMPLES	12	12	12	12	12	12	12
CVZ	195.9	81.6	346.4	.0	134.6	235.8	57.8
SE(MEAN)	6.663	21.756	8.488	.000	2.361	14.717	23.419
SEX	56.6	23.5	100.0	.0	38.9	68.1	16.7

STAND TABLE NO. 2

R6-SBW IMPACT PLOTS 1981-1985

DITCH PLOT \*\*\* PERCENT BARE TOP GRAND FIR \*\*\*

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	GREEN TOP	ONE PERCENT	TWO PERCENT	THREE PERCENT	FOUR+ PERCENT	OTHERS	TOTAL ALL CLASSES
4	.0	.0	.0	.0	.0	.0	.0
6	25.4	.0	.0	.0	.0	17.0	42.4
8	.0	.0	.0	.0	.0	9.5	9.5
10	15.3	.0	.0	3.1	.0	6.1	24.5
12	19.1	.0	.0	.0	.0	4.2	23.3
14	10.9	1.6	.0	.0	.0	1.6	14.1
16	8.4	1.2	.0	.0	1.2	.0	10.8
18	2.8	.0	.0	.0	.0	2.8	5.6
20	2.3	.0	.0	.0	.0	3.1	5.4
22	.6	.0	.0	.0	.0	1.3	1.9
24	.5	.0	.0	.0	.0	1.6	2.1
26	.0	.0	.0	.0	.0	.5	.5
28	.0	.0	.0	.0	.0	.0	.0
30	.0	.0	.0	.0	.0	.3	.3
32	.0	.0	.0	.0	.0	.0	.0
-----							
TOTAL	85.3	2.8	.0	3.1	1.2	48.0	140.4
PERCENT	60.8	2.0	.0	2.2	.9	34.2	100.0
DBH(OMD)	11.8	14.9	.0	10.0	16.0	12.1	12.0
NO. SAMPLES	12	12	12	12	12	12	12
CV%	83.5	236.0	.0	346.4	346.4	153.6	57.8
SE(MEAN)	20.583	1.875	.000	3.056	1.194	21.269	23.419
SE%	24.1	68.1	.0	100.0	100.0	44.3	16.7

STAND TABLE NO. 2

R6-SBW IMPACT PLOTS 1981-1985

DITCH PLOT \*\*\* PERCENT BARE TOP DOUGLAS-FIR \*\*\*

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	GREEN TOP	ONE PERCENT	TWO PERCENT	THREE PERCENT	FOUR+ PERCENT	OTHERS	TOTAL ALL CLASSES
4	.0	.0	.0	.0	.0	.0	.0
6	.0	.0	.0	.0	.0	42.6	42.6
8	.0	.0	.0	.0	.0	9.5	9.5
10	3.1	.0	.0	.0	.0	21.4	24.5
12	4.2	.0	.0	.0	.0	19.1	23.3
14	1.6	.0	.0	.0	.0	12.5	14.1
16	.0	.0	.0	.0	.0	10.7	10.7
18	.9	.0	.0	.0	.0	4.7	5.6
20	1.5	.0	.0	.0	.0	3.8	5.3
22	.0	.0	.0	.0	.0	1.9	1.9
24	.0	.0	.0	.0	.0	2.1	2.1
26	.5	.0	.0	.0	.0	.0	.5
28	.0	.0	.0	.0	.0	.0	.0
30	.0	.0	.0	.0	.0	.3	.3
32	.0	.0	.0	.0	.0	.0	.0
=====							
TOTAL	11.8	.0	.0	.0	.0	128.6	140.4
PERCENT	8.4	.0	.0	.0	.0	91.6	100.0
DBH(OMD)	14.4	.0	.0	.0	.0	11.7	12.0
NO. SAMPLES	12	12	12	12	12	12	12
CV%	195.9	.0	.0	.0	.0	60.8	57.8
SE(MEAN)	6.653	.000	.000	.000	.000	22.569	23.419
SE%	56.6	.0	.0	.0	.0	17.6	16.7

**Appendix D**  
**Kline Spring**

\*\*\* STAND TABLE OF BASAL AREAS PER ACRE \*\*\*

TOTAL	28.0	98.0	4.0	.0	12.0	78.0	178.0
PERCENT	14.6	32.6	2.2	.0	6.7	43.8	100.0
DBH(OD)	29.3	14.0	15.3	.0	18.3	12.3	15.9
NO. SAMPLES	10	10	10	10	10	10	10
CV%	120.9	80.4	210.8	.0	86.1	66.7	27.2
SE (MEAN)	9.911	14.742	2.667	.000	3.266	16.452	15.333
SE%	39.1	29.4	66.7	.0	27.2	21.1	8.6

STAND TABLE NO. 2

R6-SBW IMPACT PLOTS

1981-1985

KLINE PLOT

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	DOUGLAS FIR	GRAND FIR	WESTERN LARCH	ENGELMAN SPRUCE	PONEROSA PINE	LOGPOLE PINE	TOTAL ALL CLASSES
4	.0	.0	.0	.0	.0	.0	.0
6	10.2	61.1	.0	.0	.0	20.4	91.7
8	5.7	11.5	.0	.0	5.7	17.2	40.1
10	11.0	18.3	.0	.0	11.0	29.2	69.5
12	2.5	20.4	2.6	.0	.0	28.0	53.5
14	1.9	3.7	.0	.0	1.9	20.6	28.1
16	1.4	2.9	.0	.0	.0	4.3	8.6
18	.0	1.1	1.1	.0	.0	1.1	3.3
20	.0	.9	.0	.0	.0	.0	.9
22	.8	.0	.0	.0	.0	.0	.8
24	.0	.0	.0	.0	.0	.0	.0
26	.0	.0	.0	.0	.0	.0	.0
28	.0	.5	.0	.0	.0	.0	.5
30	.0	.0	.0	.0	.0	.0	.0
32	.4	.0	.0	.0	.0	.0	.4
34	.0	.0	.0	.0	.0	.0	.0
36	.0	.3	.0	.0	.0	.0	.3
38	.0	.0	.0	.0	.3	.0	.3
40	.0	.0	.0	.0	.0	.0	.0
42	.0	.0	.0	.0	.0	.0	.0
44	.6	.0	.0	.0	.0	.0	.6
46	.0	.0	.0	.0	.0	.0	.0

TOTAL	34.5	120.7	3.7	.0	18.9	120.8	298.6
PERCENT	11.6	40.4	1.2	.0	6.3	40.5	100.0
DBH(OMD)	11.9	9.4	14.1	.0	11.0	10.9	10.5
NO. SAMPLES	10	10	10	10	10	10	10
CV%	132.7	65.8	229.5	.0	113.4	99.1	45.1
SE(MEAN)	14.455	25.095	2.669	.000	6.764	37.906	42.608
SEX	42.0	20.8	72.6	.0	35.9	31.3	14.3

KLINE PLOT

\*\*\* PERCENT BARE TOP GRAND FIR \*\*\*

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

DIAMETER CLASS	GREEN TOP	ONE PERCENT	TWO PERCENT	THREE PERCENT	FOUR+ PERCENT	OTHERS	TOTAL ALL CLASSES
-------------------	--------------	----------------	----------------	------------------	------------------	--------	----------------------

4	.0	.0	.0	.0	.0	.0	.0
6	40.5	20.3	.0	.0	.0	30.6	91.4
8	11.5	.0	.0	.0	.0	28.6	40.1
10	14.7	3.7	.0	.0	.0	51.3	69.7
12	20.4	.0	.0	.0	.0	33.1	53.5
14	1.9	1.9	.0	.0	.0	24.3	28.1
16	2.9	.0	.0	.0	.0	5.7	8.6
18	.0	1.1	.0	.0	.0	2.3	3.4
20	.9	.0	.0	.0	.0	.0	.9
22	.0	.0	.0	.0	.0	.8	.8
24	.0	.0	.0	.0	.0	.0	.0
26	.0	.0	.0	.0	.0	.0	.0
28	.5	.0	.0	.0	.0	.0	.5
30	.0	.0	.0	.0	.0	.0	.0
32	.0	.0	.0	.0	.0	.4	.4
34	.0	.0	.0	.0	.0	.0	.0
36	.3	.0	.0	.0	.0	.0	.3
38	.0	.0	.0	.0	.0	.3	.3
40	.0	.0	.0	.0	.0	.0	.0
42	.0	.0	.0	.0	.0	.0	.0
44	.0	.0	.0	.0	.0	.6	.6
46	.0	.0	.0	.0	.0	.0	.0

TOTAL	93.6	27.0	.0	.0	.0	178.0	298.6
PERCENT	31.3	9.0	.0	.0	.0	59.6	100.0
DBH(MOD)	9.7	8.2	.0	.0	.0	11.2	10.5
NU. SAMPLES	10	10	10	10	10	10	10
CV%	78.4	164.9	.0	.0	.0	58.0	45.1
SE(MEAN)	23.230	14.098	.000	.000	.000	32.628	42.608
SEX	24.8	52.1	.0	.0	.0	18.3	14.3



STAND TABLE NO. 2

R6-SBW IMPACT PLOTS 1981-1985

KLINE PLOT \*\*\* PERCENT BARE TOP DOUGLAS-FIR \*\*\*

## \*\*\* STAND TABLE OF TREES PER ACRE \*\*\*

=====

DIAMETER CLASS	GREEN TOP	ONE PERCENT	TWO PERCENT	THREE PERCENT	FOUR+ PERCENT	OTHERS	TOTAL ALL CLASSES
-------------------	--------------	----------------	----------------	------------------	------------------	--------	----------------------

=====

4	.0	.0	.0	.0	.0	.0	.0
6	10.2	.0	.0	.0	.0	81.3	91.5
8	.0	5.7	.0	.0	.0	34.4	40.1
10	7.3	3.7	.0	.0	.0	58.7	69.7
12	2.5	.0	.0	.0	.0	50.9	53.4
14	1.9	.0	.0	.0	.0	26.2	28.1
16	1.4	.0	.0	.0	.0	7.2	8.6
18	.0	.0	.0	.0	.0	3.4	3.4
20	.0	.0	.0	.0	.0	.9	.9
22	.8	.0	.0	.0	.0	.0	.8
24	.0	.0	.0	.0	.0	.0	.0
26	.0	.0	.0	.0	.0	.0	.0
28	.0	.0	.0	.0	.0	.5	.5
30	.0	.0	.0	.0	.0	.0	.0
32	.4	.0	.0	.0	.0	.0	.4
34	.0	.0	.0	.0	.0	.0	.0
36	.0	.0	.0	.0	.0	.3	.3
38	.0	.0	.0	.0	.0	.3	.3
40	.0	.0	.0	.0	.0	.0	.0
42	.0	.0	.0	.0	.0	.0	.0
44	.6	.0	.0	.0	.0	.0	.6
46	.0	.0	.0	.0	.0	.0	.0

$\bar{x} =$   
 $S_x =$

=====

TOTAL	25.1	9.4	.0	.0	.0	264.1	298.6
PERCENT	8.4	3.1	.0	.0	.0	88.4	100.0
DBH(MM)	17.9	8.8	.0	.0	.0	10.3	10.3
NO. SAMPLES	10	10	10	10	10	10	10
CV%	187.1	217.1	.0	.0	.0	54.6	45.1
SE(MEAN)	14.921	6.450	.000	.000	.000	45.638	42.608
SEX	59.7	68.6	.0	.0	.0	17.3	18.3

=====